# Net Revenue Differences for Sellers in Online and Traditional Swine Auction Markets

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**ABSTRACT:** According to common sense and economic theory, farmers, along with all other vendors, are in continual search for any increment available to augment profit margins and sustain competitiveness. As a result, novel sales techniques have arisen, one of which is online marketing. The focus of this thesis is the hog sector. Some means of electronic livestock sales have shown to have a positive effect on producer revenue presumably because competition is boosted via geographic enlargement of buyer pools. Nevertheless, most historic electronic agricultural markets were established merely for academic study and were subsequently disbanded. Whether or not an online venue will generate higher profits for livestock producers today remains unknown. The core objective of the proposed research is to detail what, if any, net revenue difference there is for livestock producers in online and offline auctions. Utilizing the market for pigs sold for show ring competitions, I will methodically document price dissimilarities between online pig auctions hosted by The Wendt Group, Inc. and regional live sales in Ohio and Indiana. The experiment will follow a matched pair design in order to minimize potentially confounding variables, such as size, breed, sex, age, seller, and quality. Sample data from 78 hogs (39 from each venue), matched on the characteristics listed above, was collected and matched pair net revenue differences were established. Data was statistically analyzed using a standard normal z-test and the non-parametric Wilcoxon test. A mean (n=39) matched pair net revenue difference of 184.8 established a noticeable online advantage. One producer provided the bulk of the matched pairs (n=27) and provided a statistically sound difference of 360.3; the probability that this difference is different than zero is 0.9512 according to the Wilcoxon test. The online sale venue, on average, yielded higher net revenue margins per head for swine producers. Online venue seller benefit and greater auction traffic can help substantiate historic claims that a rise in electronic transaction expenses is easily compensated for via superior bidder competition. Hog farmers may increase profit dividends by 20% through

the use of online auction services which may improve industry efficiency and competitiveness. Further study is warranted to better link these conclusions to the financially troubled commercial swine industry.

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## Introduction

There are few economic processes as embedded into the human race as the dynamic of an auction market. Herodotus claims that auctions were being used around 500 B.C. to sell women in Babylon. Monks in China used a form of estate auction to sell the belongings of deceased colleagues in the seventh century (McMillan et al. 1997). Today, auctions are utilized to market a vast array of products via numerous different venues and auction styles. One such venue which has continued to see exponential growth, due to the current technology craze, is that of electronic marketing. In the mid 1940s, "Selevision" was implemented as the first recorded electronic agricultural market, as a means to distribute Florida citrus fruit (Henderson 1984).

"Electronic Marketing" is defined by Henderson (1984) as concurrent sales barter between geographically dispersed buyers and sellers available through centralized electronic means. Not only do products change hands later, they are sold by typographical or visual description instead of live inspection by interested persons. Note that for the purpose of this study and those before it, this description has been limited to computerized markets in which competitive price synthesis is established via a type of auction variation, excluding mere private negotiations between a single producer and consumer. Fundamental economic theory expresses the simple, perhaps obvious, fact that sellers will strive for profit maximization (Reynolds et al. 2008). As of late, more sellers are intrigued by the potential of online auctions to reduce sale transaction costs, increase merchandise exposure, and augment profit dividends. This interest has

been stimulated by the work of many, including Schrader (1984), who claims electronic markets can merit net pricing better pleasing both purchaser and vendor at the same time.

Previous scholarly work has highlighted the use of electronic markets to sell agricultural goods. In 1984, Henderson documented that a total of six computerized trading systems had been established for agricultural means in the United States. These included the Hog Accelerated Marketing System (HAMS), the Cattle Exchange (CATTLEX), the National Electronic Marketing Association (NEMA), the Egg Clearinghouse (ECI), the American Meat Exchange's Computer Assisted Trading System (CATS), and TELCOT, a private cotton trade (Henderson 1984). Schrader (1984) summarizes the resultant conclusions drawn from the aforementioned systems. ECI displayed weak evidence of higher electronic pricing, NEMA had a significant promissory effect on pricing, TELECOT registered no change, and CATTLEX indicated a $2.23/cwt. price addition when compared to close proximity, traditionally auctioned, similar cattle. A consistent price level increase across commodities may have been the result of an early novelty effect, but was sustained through reduced electronic transaction costs and a shift in market power to the less concentrated side of the market.

Superior Livestock Auction, the largest satellite video cattle sale, also offers a rich research environment and is well documented by Bailey et al. (1991). A comparison was made between the video auction and three regional auctions, netting a positive result of higher pricing via electronic sale. The study is comprehensive in its analysis- adjusting for quality, transportation, commissions, and days to delivery contrasts. The reasons given for higher SLA lot totals included lower transaction costs and a more competitive, anonymous bidding environment made possible through the auction's ability to draw from a farther-reaching clientele base (Bailey et al. 1991).

However, most relevant and pertinent to the proposed research is the discussion of the HAMS pilot system by Rhodus et al. (1989). The experimental program's daily hog prices were periodically compared to those of Indiana and Ohio traditional auctions. Primarily, Rhodus et al. sought to determine whether HAMS increased market competition and subsequently the profit of sellers. Formulated and implemented by The Ohio State University (OSU), the Ohio Department of Agriculture (ODA), and the Producers Livestock Association (PLA), the electronic HAMS system temporarily replaced a direct slaughter market and served as auctioneer, accountant, communicator, and reporter (Rhodus et al. 1989). Systematic auctions were processed by a Hewlett-Packard 3000 computer through which buyers could access lot details compiled by PLA. Bids were remotely placed via sponsored terminals which enabled sale access to a superior population demographic. In the end, the study revealed a positive price differential for farmers in the likeness of $0.94 to $0.99 per 100 pounds sold, in spite of higher transaction costs.

Recent work involving electronic commerce has been limited primarily to power markets such as eBay. As Reynolds et al. so eloquently states, "The high volume of auctions, the standardized sales conditions, the variety of sellers and product types, and the relative ease of data collection [of online auctions] create a rich research environment (2009)." Unfortunately, most recent work is neither relevant to agriculture nor focused on pricing, with the exception being work by Diekmann et al. involving online and offline used tractors sales. The article justly recognizes the unique situation of agriculture, in that production continues to become more concentrated among fewer parties. Consequently, the Internet provides an invaluable stage unto which superior lots of buyers and sellers can gather to support a geographically detached industry (Diekmann et al. 2008). Perhaps surprisingly, their work revealed lower average prices in the electronic market, eBay. They argue the lower prices may be due to the detraction of

buyers due to the risk of online fraud, insufficient data adjustment for differing transportation costs, and the different auction mechanisms used in eBay and offline auctions (Diekmann et al. 2008). Diekmann et al.'s study did not analyze electronic *livestock* marketing nor was it able to control for possible differences in quality between items offered online and offline.

The aforementioned studies of electronic livestock marketing are outdated and may miss key innovations in electronic markets that may alter results in current times. They employ the use of discontinued computer technologies and factor in numerous computational woes of the previous age. In addition, all of the previously gathered empirical evidence on livestock was gleaned from test systems activated merely for academic study. Many of the electronic test markets were disbanded following the conclusion of the study, regardless of the success they may or may not have had. Why then was the novel electronic auctioning method not widely accepted and initiated? Perhaps due in large to lagging computer performance proportionate to the market need and a public distrust and insecurity concerning the anonymous, technologically advanced bidding means.

My research provides current insight into the effects of online auctions on seller net revenue by using data from online and offline show pig auctions. Show pigs are one segment of the animal industry seeing unbridled growth. While the livestock show segment is a minute factor within the larger hog sector, it proves an invaluable means to invoke youth interest in agriculture and provides a natural laboratory to comprehensively investigate the field of livestock marketing. Multiple electronic listings have emerged to cater to market show-oriented stock, creating a figurative oasis for economic inquiry into the effects of a modern online market. The date is gathered from the Wendt Group Inc.'s online hog auctions hosted by *www.showpig.com*

and similar traditional auctions. The study documents sellers' revenue differences between the two venues, which may inform agribusiness of potential growth opportunities.

## Materials and Methods

I collected price data for 78 club pigs sold in regional online and offline auctions (39 from each) in the spring of 2010. The offline auctions took place in Archbold, OH, Wapakoneta, OH, and Reynolds, IN while the online auctions were hosted by The Wendt Group Inc. on www.showpig.com. Club pigs are young animals purchased with the intent of being shown at fairs and livestock expositions. A multi-stage sampling plan was used to select the 78 pigs analyzed. Online sales were drawn exclusively from showpig.com while offline sales were drawn from traditional regional auctions with buyers and sellers of similar geographic spread and sellers with similar quality animals as those who frequent the online sale site. Simply put, these online and live auctions were chosen because they featured similar quality pigs and a similar group of bidders. Three breeders supplied the sample group and were selected based on reputation and the fact that they market stock in both venues.

Online auctions were conducted on February 25 and March 18, 2010. An ascending bid, first price English auction rule was used. Bidders were allowed to register any time prior to sale day and underwent credit verification before final authorization was given to participate as a buyer. This particular online auction format has maximum bid and auto-extend time features. Bidders may input a maximum bid enabling automatic bidding by set bid increments up to a designated highest price. Bidding on a particular lot may stay open past the original ending time if the item has received a bid within the last 5 minutes. Bidding remains open until bidding activity has ceased in the 5 minute extension window. Pigs are sold as individual lots based upon a picture and short description from the seller. Each one day auction is open from 8am to 8pm, at

which time the first lot is scheduled to close; each subsequent lot then closes one minute after the previous, unless the auto-extend feature is enabled. Buyers then pay the high bid and contact the seller to arrange delivery, at the buyer's expense, from the seller's location.

Offline sales were held on April 8, 10, and 18, 2010 and used an open outcry, ascending bid, first price auction format. Pigs from multiple producers were comingled at a central location and transported to the sale venue by the seller. Lots were available on site for bidder inspection prior to the auction. Pens of one to five pigs were sold as lots in which the high bidder selected their singular choice; after which, the auction continued, selling the remaining pigs in that pen before moving to the next sale lot. Bidders registered immediately preceding the auction and were not subject to credit check. Ownership is transferred following the sale and the buyer is responsible for transportation from the sale. Buyers from either venue tended not to purchase in large numbers. The likelihood of quality sorting by sellers between online and offline auctions is minimal due to the calendar difference between venue dates. Pigs of the ideal age for late winter online sales would be too old for promotion in early spring, and vice versa.

A matched pair experimental design was chosen to reduce extraneous variables, not unlike the process outlined by Mendenhall (1993). Data pairs were formed via breed, sex, age, and quality factors; the latter being most challenging to quantify within this study's given time constraints. Even so, quality was accessed through breeder homogeneity and genetic line merit. Paired animals are of analogous breed and sex, within 7 days in age, are bred by the same producer, and descend from similar paternal lineage. When multiple pigs satisfied pairing criteria, a random number table was used to define the matched pair. Sale data was compiled and sorted using Microsoft Excel software.

Since the ultimate goal of this work is to judge seller net revenue disparities (R) between online (o) and traditional (t) settings, the raw sale prices per head (P) were adjusted for transaction (K) and transportation (C) costs of the vendor according to the subsequent formulas:

$$R_o = P_o - (K_o + 0.10P_o)$$

$$R_t = P_t - (K_t + C_t + 0.02P_t)$$

Online venue costs include sale commission ($0.10P_o$) and listing charges whereas live sale fees encompass facility rental, auctioneer commission ($0.02P_t$), bid caller wages, sale printings, consumable supplies, and livestock transport. Within each matched pair *i*, live net revenue was subtracted from online net revenue to generate the net revenue difference for each matched pair, defined as $\mu_i$. A standard normal z test was conducted under the null hypothesis ($H_o$: $\mu = 0$) where $\mu$ is the mean of $\mu_i$ across all matched pairs ($i$ =1 to $n$). The possible alternative hypotheses ($H_a$: $\mu > 0$, $\mu < 0$, and $\mu \neq 0$), were tested under the assumptions of random sampling and a normal distribution. The test statistic was calculated as:

$$z = \frac{\mu}{SE(\mu)} \quad \text{where} \quad SE(\mu) = \frac{\sigma}{\sqrt{n}},$$

and $\sigma$ is the standard deviation of $\mu$. Finally, to check the robustness of this test to possible non-normality of the distribution of net revenue differences, the Wilcoxon Signed-Rank Test was also conducted. The procedure uniquely converts $\mu_i$ differences into "signed ranks" and utilizes a summation statistic [W] with an approximately normal sampling distribution, sanctioning for the calculation of a z-ratio (Lowry 1999). The following formulas, in conjunction with a table of critical z values, determine significance levels.

$$-\mu_w = 0 \qquad -\sigma_w = \sqrt{\frac{N(N+1)(2N+1)}{6}}$$

$$z = \frac{W}{\sigma_w}$$

Where W is the sum of the signed ranks (1 to N), $\mu$ is the mean of the sampling distribution of W, and $\sigma$ is the standard deviation of the sampling distribution of W.

## Results and Discussion

Transportation and transaction costs differ between the live and online auction venues. Consequently, these costs factor into the conversion of gross price into seller net revenue, which is the focus of my analysis. It is noteworthy to recognize transportation costs as negligible and online transaction costs as significantly more expensive than transaction costs for live auction venues.

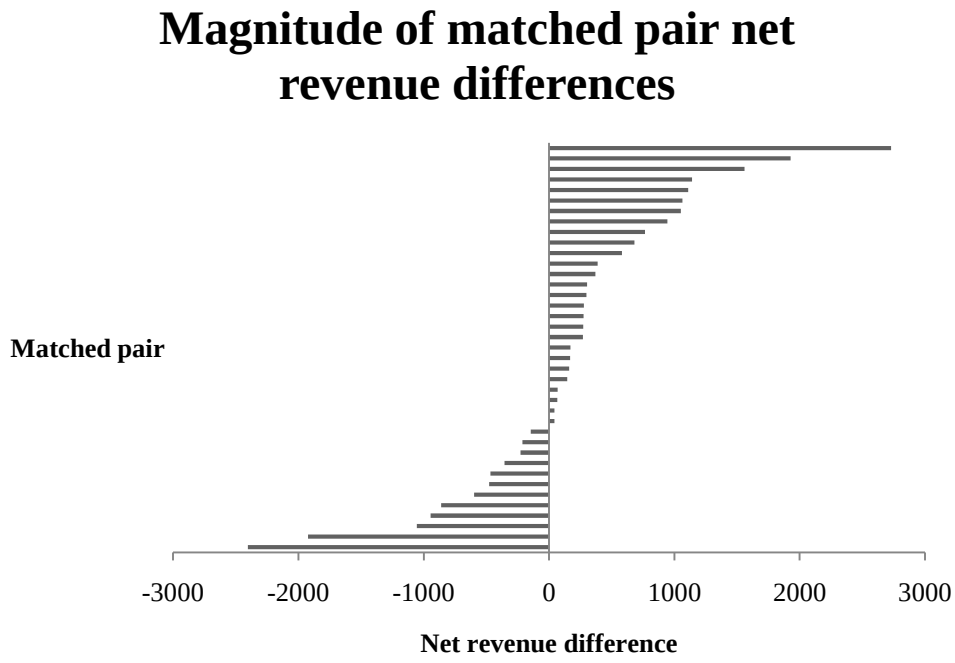
| Venue | Transportation cost | Transaction cost(s) |
|---|---|---|
| **Online** | Transport of livestock from the seller at buyer's own expense. (no cost borne by the seller) | $20/animal flat fee plus 10% of gross |
| **Traditional (live)** | Seller transports livestock to the sale facility; calculated at $0.28/mile. (based upon fuel costs at 11 mpg, with a 20 pig/load limit)<br>$0.18-4.97/animal | 2% of gross<br>facility rental - $250 ($1.92-3.13/animal)<br>shavings - $4/bag ($0.83-0.95/animal)<br>bid callers - $250 each ($5.77-9.38/animal)<br>sale printings - $0.15/copy ($0.23-0.38/animal) |

In matched pair 1, 126-1 sold online for $575 and 20-1 sold for $350 at live auction. No online transportation cost is assumed by the seller, so gross price less a $20 fee and ten percent commission becomes online seller net revenue at $497.50. 20-1 sold in an April 10, 2010 sale in Archbold, OH and was hauled 10 miles to the auction site. Four loads were used to deliver the 79 club pigs from Wauseon, OH. Using round trip mileage, total transportation cost was $23.12, or $0.29 per pig sold. One bag of shavings was used for every four pigs, three bid callers were

hired, and 200 sales catalogues printed for the sale. Shavings, wages, facility rental, and printing cost are calculated as an overall fee divided by the number of pigs sold. Given a two percent commission charge, live seller net revenue within pair 1 is $328.90.

| Entire sample | | | Single producer | | |
|---|---|---|---|---|---|
| Matched pair revenue difference | Frequency | Cum % | Matched pair revenue difference | Frequency | Cum % |
| <-1000 | 3 | 7.7% | <-500 | 3 | 11.1% |
| -1000 to -300 | 6 | 23.1% | -500 to 0 | 5 | 29.6% |
| -299 to 0 | 3 | 30.8% | 1 to 150 | 3 | 40.7% |
| 1 to 300 | 13 | 64.1% | 151 to 500 | 8 | 70.4% |
| 301 to 1000 | 7 | 82.1% | 501 to 1500 | 5 | 88.9% |
| >1000 | 7 | 100.0% | >1500 | 3 | 100.0% |
| Total | 39 | | Total | 27 | |

A mean matched pair net revenue difference of 184.8 (p=0.219) was calculated from the sample of all producers (n=39). This positive difference indicates that the online auction venue yielded higher net revenue for sellers. One producer provided the bulk of the matched pairs (n=27), allowing for greater homogeneity between the paired animals. Within this subsample, the mean revenue difference was 360.3 (p=0.026). From a nonparametric statistical perspective, the study provides mixed results. The significance level for all observations falls just outside a normally accepted threshold at p=0.103. Nevertheless, when the pairs originate from a single producer, the statistic is quite robust (p=0.049).




A negative difference denotes that live auction seller net revenue was superior, whereas a positive matched pair difference correlates to higher online net revenue within the pair. Twenty-seven matched pairs favored the online market as advantageous with a mean difference of 625.1. Twelve live sale hogs outsold their online counterparts by an average of 805.9. Online net revenue averaged 1113.15, in comparison to a live result of 928.38. Therefore, the three analyzed hog farmers increased their sale profit margin by 20% through the use of online auction services.

Pigs sold online produced greater net revenue than their offline contemporaries for the three sellers studied. Although the study focuses on a niche sector of the hog industry, it suggests that online selling may be able to benefit sellers in other sectors of the global hog industry. The dependent variable, net revenue, is composed of three components: gross sale price, transactions costs and transportation costs. My finding is driven by differences in gross sale price as cross-venue differences in transaction and transportation costs were insubstantial. For the seller, auction commissions and listing fees were the sole determinants of online transaction cost and

actually exceed the costs associated with live auctions. This suggests that business opportunities may exist for establishment of other electronic sales venues for hogs.

The seller's advantage that exists within the online venue of www.showpig.com may be the result of increased bidder competition. While regional live sales average crowds of mere hundreds, a May 2010 report by The Wendt Group Inc. reported 8,000 bidders and nearly 3 million visits on their online swine auction site. Still, only 5% of respondents to a showpig.com survey chose online auctions as their favorite venue for buying pigs. Some aversion exists towards the use of online auctions from a buyer perspective; perhaps due to the inability of purchasers to inspect lots in person. However, both buyers and sellers benefit from online transactions as the hogs do not travel to a central sale location where they are exposed to additional stress and potential disease.

An increase in sale net revenue through the use of online marketing agrees with the findings of Rhodus, Baldwin, and Henderson in that a costlier electronic transaction yields higher net profit by joining together a large group of bidders (1989). However, the revenue boost is not resultant of a reduction in transaction costs, like that found in the Superior Livestock satellite video cattle auction (Bailey et al., 1991). Further study documenting show quality rankings of studied hogs throughout the summer may further confirm the absence of quality sorting between venues.

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## References


Bailey, DeeVon, Monte C. Peterson, and B. Wade Brorsen. "A comparison of video cattle auction and regional market prices." *American Journal of Agricultural Economics.* 73(1991):465-75.

Diekmann, Florian, Roe, Brian E., and Batte, Marvin T. "Tractors on eBay: Differences between internet and in-person auctions." *American Journal of Agricultural Economics.* 90(2008):306-20.

Henderson, Dennis R. "Electronic marketing in principle and practice." *American Journal of Agricultural Economics.* 66(1984):848-53.

Lowry, R. (1999). Non-parametric alternative: The Wilcoxon signed-rank test. In *Concepts and applications of inferential statistics* (chap. 12a). Retrieved from Vassar College website: http://faculty.vassar.edu/lowry/webtext.html

McMillan, John, Rothschild, Michael, and Wilson, Robert. "Introduction." *Journal of Economics & Management Strategy.* 6(1997):425-30.

Mendenhall, W. (1993). *Beginning statistics A to Z.* Belmont, CA: Wadsworth.

Reynolds, Kristy E., James H. Gilkeson, and Ronald W. Niedrich. "The influence of seller strategy on the winning price in online auctions: A moderated mediation model." *Journal of Business Research.* 62(2009):22-30.

Rhodus, W. Timothy, E. Dean Baldwin, and Dennis R. Henderson. "Pricing accuracy and efficiency in a pilot electronic hog market." *American Journal of Agricultural Economics.* 71(1989):874-82.

Schrader, Lee F. "Implications of electronic trading for agricultural prices." *American Journal of Agricultural Economics.* 66(1984):854-58.